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ABSTRACT

In order to provide a framework for addressing computer literacy and program development considerations, this document discusses issues in computer implementation on higher education campuses and outlines a preliminary plan for Cedarville College to meet computer-related needs of faculty and students. The growth of the computer industry and the response of educational institutions is summarized, and the dilemmas caused by rapid technological advancements are examined. An analysis of problems involved in defining computer literacy concludes by suggesting a multi-level view of computer literacy as a means of addressing both student and faculty needs for computer-based education, as well as continuing a commitment to the liberal arts. Computer-based education, computer-managed instruction, and computer-assisted instruction are briefly explained. Program goals are identified and discussed from the perspective of both faculty and student computer literacy issues, and 10 initial educational objectives for computer-based education at Cedarville College are listed. A summary of current plans to meet the objectives describes new computer system purchases, development of an Academic Computer Center, and 10 parallel efforts to assure optimum use of the new system. Footnotes cite 23 sources. (LMM)

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COMPUTER-BASED EDUCATION AT CEDARVILLE COLLEGE:

A WHITE PAPER

Presented to the
Administration and Faculty
of Cedarville College

by

Rex M. Rogers
Director of Academic Computer Services
with
The Academic Computer Users Committee
November, 1983

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PREFACE

What is a White Paper?

White papers are often issued by governments or organizations to explain their position(s) on new issues. Generally, these documents represent the collective thinking of the individuals responsible for defining policy in relation to some new problem. They are the product of several weeks, or even months, of cumulative effort and are intended to clarify the stance of the policy-makers both to other workers within their own organization as well as to the general public. Although these papers are not always viewed as the "final analysis" by their writers, they are frequently treated in this fashion by the public.

The recent phenomenal increase in computer-related tasks in society has placed a new and rather unique burden upon American educational institutions that demands such a white paper. In particular, the rapid development of computer capabilities, decreases in costs, and the advent of the micro, have put computers within reach of most businesses and a large percentage of individuals. Such a climate of growth has created a "boom period" for anything remotely related to computers and has produced an ever increasing demand for programming courses, computer science majors, computer-assisted instruction in the classroom, and the new buzzword, "computer literacy."

In an effort to respond, educational institutions have allowed computer-based education programs to develop quickly in a wild and woolly, incremental, and "catch-as-catch-can" manner. Such unrestrained and largely unplanned growth has stimulated new management

problems and a whole host of unanswered questions. For example, who should be responsible for coordinating campus computer facilities and future acquisitions? In other words, who should have control? What does computer literacy mean? Should every student take a programming course? How should computer literacy be achieved? Should a college emphasize faculty development in computer literacy or computer literacy proficiency for the student? Needless to say, the list could continue ad infinitum, ad nauseum.

In the past two years, Cedarville College has faced these and a variety of related dilemmas. In order to respond in a reasonably rational manner, the college administrators instituted an Academic Computer Task Team to examine the issues and to recommend a course of action. The first phase of the team's work ended with a report to the President outlining hardware and software needs and recommendations.

At that time the Task Team was officially disbanded and a permanent Academic Computer Users Committee was created by the President comprised of representatives from each academic department. The committee is responsible for advising the administration and departments concerning acquisition of hardware and software, and to act as a policy board for the college's new Computer Center. A director of Academic Computer Services was appointed and charged with the following responsibilities:

1. Administration of the college Computer Center.
2. Fulfillment of a liaison role with the faculty that is designed to encourage their use of computer facilities and professional growth through development of computer-related skills.
3. Continuous, director-initiated discovery of new software on behalf of the faculty in all educational fields.

The second, and still evolving phase to be developed by the committee is represented by this white paper on computer-based education at Cedarville College. It is the desire of committee members that this paper be treated as a "working draft." As such, it should have a dynamic quality about it that encourages thinking and continued input by all who read it. It is hoped that the strategy found herein is comprehensive enough to allow the college to avoid being "caught unawares," while flexible enough to permit the college to respond to, and benefit from, technological change.

INTRODUCTION

The Greening of the Computer

It is probably not an exaggeration to assert that nearly every respectable periodical printed in America has carried at least one article on computers in the last twelve months. Computers have been examined in articles ranging from very practical "how to buy" pieces to rather lofty considerations of their impact upon the present and future. Symbolic of both types of articles is Time magazine's designation of the computer as the "Machine/man of the year."[1]

Until very recently, the influence of computer technology upon education had been reasonably controlled and therefore predictable. Large academic institutions purchased "mainframes" for their administrative needs in the 60's and then gradually allowed academic access for the purpose of research. Following in the late 60's and 70's, students began to use computers in classroom projects aimed at preparing them for careers in business. Very few smaller colleges were able to develop significant computer

facilities at that time, primarily due to the high cost of the equipment.

The decade of the 70's, however, witnessed the marketing of an earlier phenomenal breakthrough in computer technology embodied in the "chip." Incredibly complex arrays of physical components could now be placed on a piece of cheap silicon the size of a person's fingernail.[2] Reductions in the size of computer parts resulted in a consequent decrease in their cost at a rate of 30 percent per year, (1959-1979).[3] By coupling this innovation with similar advances in technology such as increased memory storage capability and more "user friendly" software, computer manufacturers were able to offer high-range computing power at mid-range prices. Mid-range prices were translated quickly into multiple sales to mid-size businesses. And, commercial and industrial computerization followed in a manner not unlike the Industrial Revolution of a century before.

If these extraordinary events were not enough to transform business and society forever, the development of the microcomputer in 1975 and its widespread marketing by 1982 provided the clincher.[4] The lower-priced "micro" for the first time placed the power of computers within range of individual budgets. One version is marketed as a "home" or "personal" computer designed to fit into family budgets and perform a variety of financial, educational, and game-related recreational tasks. Computers such as the Apple, Radio Shack's TRS-80, Commodore's Pet, and the Atari 800 have become household words.

Another significant type of microcomputer is the "professional" model micro, capable of handling any of the tasks mentioned above

but designed primarily to meet business needs. Word processing, larger data storage and "number crunching" capabilities, and electronic mail are a few examples of its workhorse applications. The leading computer manufacturers such as IBM and DIGITAL, along with a host of others, all have professional models.

The micro has been the tour de force of the computer industry. It is, and will be, the backbone of a computerized society. Although the social and economic consequences of the computer revolution have only begun to be examined, some developments are immediately apparent:

... In 1960, there were only 1,000 computers in the U.S. worth $2.5 billion, in 1965 there were 35,000 worth $8 billion.[5]

... In 1981, at least 3 million micros were sold in the U.S.

... There were an estimated 400,000 "large" computers in the world in 1982.[6]

... Today, an estimated 800,000 people use micros in business.[7]

... By the end of 1982, computers were in about 4 million homes with some authorities predicting that most American homes will have them by the year 2000. There are now some 400 computer clubs nationwide and an estimated 75 computer magazines.[8]

In light of these developments, strong credence must be given to a recent statement by a Drexel University professor: ". . . there is no significant sector of the economy which is not already computer dependent."[9]

The Educational Response, The Educational Dilemma

In 1950, no college or any other educational institution had even one commercial computer.[10] In 1983, 90 percent of higher educational institutions have computer facilities with nearly half being used for administration purposes only.[11]

Spurred by the arrival of the micro, academia at all levels has attempted to define and meet the computer-based education needs of an emerging computer culture. But, unfortunately, this has produced a long list of dilemmas. To make matters even worse, campus computing strategies in many instances simply did not exist. Some institutions allowed mathematics or science departments to develop computer facilities while others depended upon business administration departments. Some purchased more terminals to enhance student use of on-campus mainframes, others permitted interested faculty to buy micros at sporadic intervals. Those acquiring micros often sought to make available a variety of models, ignoring "compatibility" considerations for any later development of computer networks. In most cases computer literacy philosophies were sketchy at best. Such "strategies" developed haphazardly and did not appropriately address a number of administrative and academic concerns.

In recent months colleges and universities have discovered to their chagrin that their costly computer facilities, programs, and courses are rather like an uncontrolled amoeba, growing healthily in all directions but with an unknown purpose and no identifiable destination.[12]

It is something of an understatement to assert that the "computer-goes-to-college" experience of this decade has been anything but a model of rational planning. For the most part this has been due to academic institutions' negligence in developing a clearly articulated campus computing philosophy; a master plan that could serve as a guide to all of the disparate educational community. The lack of such a plan may be attributed to several factors including:

1. The fast paced, "leap-frog" nature of technology in the computer industry.[13]

2. "Option shock" upon the part of those responsible for acquiring the requisite hardware and software.[14]

3. The inertia that is seemingly an inherent quality of all organizations, especially those facing rapid change.

4. Absence of a computer literate faculty and administration.

5. The lack of funds, a perennial problem in both public and private education.

6. Uncertainty as to the exact nature of the demands being placed upon the academic community. An often asked question that is both simple and profound is, "Just what are we attempting to accomplish?"

Needless to say, educational institutions must know what they are about in relation to computer-based education. The prosperity of most institutions will hang in the balance. For others, an appropriate response to a computerized society will have a direct correlation with their chances of survival.[15] Whether public or private, elementary, secondary, or higher education, schools must develop a workable and widely understood plan of action.

DEFINITIONS

What is Computer Literacy?

No credible authority any longer disputes the fact that computers are here to stay and that they have brought with them certain "givens" for society and thus, for education. A few of the more important of these social factors include:

1. Computer-related or assisted work will be the norm, not the exception, regardless of one's chosen profession.

2. Occupational skills that once led to employment are now being replaced by the new computer-related skills.

3. Graduating students and faculty must have some level of computer literacy to function at their highest potential in a computerized society.

"Computer literacy" is the current buzzword in education. Everyone is talking about it, everyone wishes they had it, everyone wants their students to acquire it, but no one knows what it is. An entire issue of The Forum for Liberal Education has been written around the theme, "computer literacy means different things on different campuses."[16] Even Robert G. Gillespie, one of the nation's leading authorities on the subject, admits that it is an ill-defined term. His final recommendation is simply to "meet the revolution with confidence by making sure that you are a part of it."[17]

Contrary to popular belief, being "part of it" may entail participation in any of several tracks, only one of which emphasizes programming. For example, the road to computer literacy may involve:

1. An awareness of computer-related technological developments and likely social consequences vis-à-vis one's profession and society. This track demands little or no "hands on" contact with computers but an investment of time in becoming knowledgeable about computer influences.

2. The ability to use computers as a powerful tool to assist one in one's profession . . . a sort of "means" to an "end." In education this concept has elicited a flood of acronyms (and consequent confusion) like CAI, CBE, CAL, or CAT.

3. The competency to program computers, that is, to design one's own software for unique applications related to one's work or to develop a proficiency in several languages permitting employment as a programmer.

4. The ability to diagnose computer hardware problems and repair them in order to provide technical support to one's employer.

As mentioned above, the academic community faces an especially perplexing dilemma in defining computer literacy because of the educational diversity represented in its constituent parts. This dilemma is at once characterized by anxiety and euphoria. Colleges are beginning to recognize that computer competency in one discipline may only be a beginning in another. Or that the chosen profession

of students, their baccalaureate major, and their interests may place unique computer requisites upon them. The college's administrative burden will, therefore, increase as it attempts to support each of these divergent needs.

On the other hand, it is fortunate that computer literacy tracks are not mutually exclusive. Like any other field, computer-related knowledge may be developed in segments or as part of a larger unified whole. In this sense, students and faculty members may enjoy a great amount of flexibility in tailoring or customizing their computer-related activity to their own broader disciplinary interests and expertise. The college need only supply the facilities to encourage such experimentation in a non-threatening and non-competitive atmosphere.

It has been said that "the definition of computer literacy selected by educators strongly influences how, where, and to what extent computers are integrated with curriculum and instruction."[18] By viewing computer literacy as attainable at several levels or in a number of tracks, Cedarville College will be able to simultaneously address the needs of its students and its faculty for computer-based education as well as to continue in its commitment to the liberal arts.

Acronyms

The current concern for computer literacy has stimulated the growth of a sometimes confusing list of acronyms, each with its loyal adherents. For the sake of clarity and to establish a point of departure for the following section, the more common list of abbreviations will be briefly defined.[19]

1. Computer-based education (CBE) is undoubtedly the most useful and broad-based concept to be found in this burgeoning field. It is an umbrella term that encompasses all of the abbreviations in this discussion

rather nicely. It includes administrative, research, and instructional applications. It may also involve a "passive" use of the computer as an instrument permitting a more efficient achievement of traditional ends, or as an "active" agent stimulating new thinking, new approaches, and new problems.

2. Computer-assisted instruction (CAI) involves the use of a computer in the actual teaching of a student, generally in a drill or practice session. The term is still widely used and probably will be for some time, but in some circles it is gradually being replaced by computer-based instruction (CBI). European teachers often use computer-assisted learning (CAL) to refer to essentially the same methods. Operationally, these terms are virtually synonomous.[20]

   CAI generally incorporates several types of applications:

   1) Drill and practice
   2) Games
   3) Testing
   4) Simulations
   5) Problem solving

3. Computer-managed instruction (CMI) is a method of using the computer to enhance the teacher's time in the classroom by facilitating record-keeping chores. CMI applications typically do not involve the student directly with the computer. A variety of activities may be subsumed under this rubric such as:

   1) Grade book work
   2) Assignments and syllabi via word processing
   3) Electronic mail
   4) Development of tests and quizzes

Probably the most cogent summarizing point that could be made is to emphasize that each of these methods is a "means" to an "end." They merely represent approaches to integrating computers with instruction in order to further any or all of education's more timeless goals. Computer literacy may emerge as a by-product of the effort.

PROGRAM GOALS

What are we trying to accomplish?

Cedarville College is a Christian liberal arts institution dedicated to the preparation of students for all of life. As a liberal arts college it attempts to broaden students' horizons through spiritual, intellectual, and emotional challenges. Two of its primary objectives state these concerns:

1. To increase the student's awareness of the world of ideas and events which are influencing our contemporary culture, and to prepare the student to knowledgeably participate in our society.

2. To offer opportunities for academic specialization and preparation for graduate study, and to assist the student in selecting and preparing for a vocation.

It is in this context that the earlier discussion of computer literacy and computer-based education finds its most meaningful niche. If, as has been contended, computers are here to stay and ultimately will be influencing every aspect of life, then it behooves an educational institution such as Cedarville College to prepare graduates for a computerized society. At least for a time, computer literacy must become a necessary emphasis.

Computer literacy is not, however, an appropriate "end" in itself. In the same way that being truly educated means more than good "reading, 'riting, and 'rithmetic" skills, so too it means more than "reading, 'riting, 'rithmetic, and 'rogramming." As critical thinking and problem-solving skills are encouraged in any worthwhile class, so too may computer-related skills be encountered and learned in many diverse settings. It is in this way that computer knowledge and understanding becomes another component of a well-rounded liberal arts education.

Computer literacy needs that vary with disciplines and individuals, therefore, are probably not easily addressed in a single "Intro" course for faculty and students alike. Rather, as was noted in the previous section, computer literacy may be achieved through a number of viable tracks. In the final analysis, what is absolutely necessary is a precise determination by each individual and each department of the level of computer literacy appropriate for them and the route through which this may be most effectively achieved. The following section will seek to address some emerging issues that often serve as obstacles to the development of such a precise determination.

Faculty and Student Computer Literacy Issues

Until now, this paper has discussed faculty and student computer literacy needs in a correlative manner. To the degree that one may assume that both groups need greater computer literacy, this is a useful and logical approach. Nevertheless, it is equally logical to assume that the time may occur when their interests and needs will diverge.

Faculty members by definition have unique demands placed upon them and need a number of computer-related experiences free from student interaction. Consider, for example, the faculty-computer issues listed below:

1. Each faculty member should thoroughly review the effects of the "computer revolution" on his or her field of expertise and seek to identify its implications for that profession and for society.

2. Faculty, whether in a large university or a small college, embody a number of levels of sophistication in computer literacy. Some are novices, others may be seeking new computer-related challenges. One or two seminars in computer literacy or one "Intro to Programming" course will not adequately address

their needs. Perhaps a better approach is to offer several "Short Courses." If these courses are structured for different degrees of prerequisite skills, the faculty can voluntarily "self-select" the sessions appropriate for them.

3. Few instructors are willing or able to commit themselves to a whole quarter or semester in a computer class. "Short Courses" on weekends, after hours, during holiday breaks, or summer vacations could provide a considerable amount of information in relation to the time spent in session.

4. Faculty do not, as professionals in a specific discipline, generally need to become programmers. Although programming is an intricate part of full flexibility in the employment of computers, it is not the "end all, or be all" of computer use (languages will continue, however, to evolve into more English-like or "user friendly" forms making programming of computers easier). Teachers do need instruction and help in CAI and the appropriate use of computer-based education that will assist them in effectively delivering their courses' substantive content.

5. A fifth area of concern involves motivation. What is the faculty member's incentive to enhance his or her computer literacy and CBE skills? Unlike students who apparently cannot get enough computer exposure, established faculty are often reluctant to invest the time necessary to "upgrade" or enhance their skills. "Re-tooling" may not be attractive unless computer-related activities are considered in college and university reward structures.[21] Integrating computer literacy emphases with faculty development is one logical answer to this dilemma. Another might be extra conference funds for CAI seminars in one's discipline.

6. Finally, it should be openly recognized that faculty members sometimes feel threatened by change and by becoming a "peer" of their students when taking a computer course. It is not easy for an established professional with well-developed expertise to admit suddenly that there is a significant area of new knowledge in which he or she is lacking. Here again, incentives offered by academic administrators become important, as do separate short courses exclusively for faculty. These courses should entail considerable "hands on" time to help them over initial hurdles and obstacles that could prove discouraging.

Consider Now These Computer Literacy/Student Issues:

1. Regardless of major, students, like faculty, should have a thorough understanding of the effects of computers on the society in which they will live and work. But it is doubtful whether one required computer literacy course could provide students with the computer-related understanding they need in their major. Such understanding could more logically be delivered by a professor in that student's field. A better method, therefore, for a liberal arts college with many general education requirements, would seem to be that chosen by Marymont Manhattan College, Pepperdine University, and Allegheny College. These institutions emphasized faculty development and classroom computer usage in place of a single course as a way to provide more computer exposure for students.[22]

2. Some students' need for computer literacy at the liberal arts college may be transitory. Freshmen are already arriving from elementary and secondary schools with BASIC and other "Intro" courses on their transcripts. If this trend continues, and all projections support the belief that it will, some undergraduates may very soon be beyond the need for such courses. They would, nevertheless, still lack awareness of computer-related influence upon their majors and professions. One caveat to note is the strong possibility that certain types of students would not have enjoyed such access in high school. Possible examples include minority students or others from poor school districts; certain inner-city or very rural district students; or students from private, "Christian," or other religious schools.[23]

It seems apparent that faculty needs and student needs differ not so much in substance as in procedure or mechanics. Both groups need more awareness of a "computer culture," both need a level of computer literacy appropriate for their professions. Procedurally, they differ slightly in the medium through which these goals may be achieved and in the way they will utilize their computer literacy. Faculty require short courses and CBE experience; students may benefit from CBE, as well as short courses, and are likely to apply their skills after graduation. Computer literacy emphases for

faculty probably require the provision of some incentive by the administration; students need little or no incentives.

Computer-Based Education Objectives

It is now possible, using a flexible definition of computer literacy, to develop a list of initial objectives for computer-based education at Cedarville College.

1. To increase the number of faculty and student computer users in all academic disciplines.
2. To encourage a growth in the number of courses utilizing computer support.
3. To stimulate an increase in the number and variety of faculty, student, and course applications.
4. To stimulate a significant growth in the professional activity and competency of the faculty in disciplinary specialties through use of computer capabilities as a tool supporting seminars and basic or applied research. Such seminars may include on-campus sessions for pastors and laymen, mission board staff, public sector managers, private sector executives, or other off-campus or "non-traditional" students.
5. To encourage more writing among faculty via word-processing capabilities.
6. To heighten students' level of graduate school readiness and performance.
7. To expand faculty and students' awareness of the social consequences of the "computer revolution."
8. To integrate computers into curriculum and instruction via computer-based education methods.
9. To effect a higher level of computer literacy as an important adjunct of a modern liberal arts education.
10. To provide faculty and students with the computer "tools" necessary for creative work in their respective fields of interest, perhaps the most important objective of all.

maintain the new system, and to oversee student lab assistants.

4. Initiation of a minor in Computer Information Systems in the fall, 1983. The minor served as a core for development of a CIS major in the fall, 1984, following the Data Processing Management Association model curriculum.

5. Implementation of a 1983 competitively-awarded $30,000 grant from the Cleveland Foundation to the Business Administration Department:

   a) to define the nature of skills required of entry-level personnel by international, national, and local corporations, and

   b) to develop curricula, courseware, and faculty expertise necessary to implement these findings.

6. Continued acquisition of additional software packages that will enable faculty to develop on-campus seminars in computer utilization for a variety of organizational and research needs. Suggested packages would include DATATRIEVE, ALL-IN-ONE, SPSS, MINITAB, PASCAL, PL/1, graphics capabilities, etc.

7. Coordination of a distributed network of micro computers in several remote locations. Such networking permits academic departments having micros, faculty members with home computers, and students owning personal computers to use their micros as terminals to access a larger computer environment. Users with greater program needs may then have more computing power available to them while tasks requiring fewer computer resources may be "off-loaded" and performed on smaller micro systems. The DEC VAX 11/750 configuration described above provides several "dial-up" ports for this purpose.

8. Employment of student lab assistants primarily from Science and Mathematics or Business Administration backgrounds. Lab assistants from each academic department are being developed. Lab assistants not only act in a consultation role but are involved in teaching "Short Courses" to other students in introductory text editing, spread sheets, and statistical package uses.

9. Placement of remote terminals and modems in academic buildings, faculty offices, and dormitories to develop an "easy access," decentralized system.

THE PLAN

How are we going to accomplish our objectives?

In order to aid faculty in accomplishing the goals outlined above, the college purchased a Digital Equipment Corporation VAX 11/750 minicomputer, a TU58 and RA80 tape and disk drive, one LA120 console terminal for system maintenance, and 20 new terminals. The initial configuration includes software (BASIC, FORTRAN, COBOL, etc.) capable of supporting or assisting instruction in all academic departments.

To house these new acquisitions, an Academic Computer Center has been developed which includes a secured, climate-controlled CPU area, office space, and two terminal labs, one for beginning students and one reserved for advanced students and faculty.

In conjunction with these plans, the college has already begun several parallel efforts to assure optimum usage of the new system. These plans include the following:

1. Dedication of one segment of the Faculty Development program to a computer-based education emphasis for the 1983-84 academic year. This continuing program, under the auspices of the Associate Academic Dean, will involve computer literacy seminars, computer-based education in-service sessions, and an effort to expand computer-assisted instruction.

2. Establishment of an Academic Computer Users Committee comprised of selected faculty members and the appointment of a director of Academic Computer Services. The primary task of the director will be to encourage increased computer awareness and literacy among the faculty (in conjunction with the Associate Academic Dean's development program) and to further stimulate the interest and capabilities of student users.

3. Employment of a full-time programmer/analyst to assist the director of Academic Computer Services in the operation of the Computer Center, to

10. Dedication of three days in the faculty and student chapel to "Christians in a Computer Culture." Speakers attempted to assess the so-called revolution and emerging "computer culture" from a Christian-theistic perspective. Questions addressed included, Is technology value-free? What is a Christian view of social and technological change? Or, what are the implications of change for society and Christian ministries?

CONCLUSION

Computers are a late twentieth century phenomenon. Students and faculty may study about them or they may study with them. Computer-based education is one group of methods that makes this study possible. Computer literacy, however defined, will be the by-product of that effort.

Students, however, will never study for computers. As electrically-powered machines, they will never displace human beings, nor will they ever be able to experience emotions and answer the "great questions of life." The absolute and ultimate objective of Cedarville College is still a quality Christian liberal arts education for each of its graduates. Computers are a modern and very important aspect of college efforts to obtain that larger and lasting goal.

FOOTNOTES

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